WHAT IS CLAIMED IS:

1. A method for producing a quantum dot silicate thin film which comprises the steps of:

displacing the surface of semiconductor quantum dots having a size of 1~100nm and synthesized by a wet chemistry technique with a silane compound having a phosphine-, amine- or thiol-based functional group and at least one reactive group for a subsequent sol-gel process;

subjecting the surface-displaced quantum dots to the sol-gel process, followed by coating onto a substrate, or coating the surface-displaced quantum dots onto a substrate, followed by subjecting them to the sol-gel process; and

heat-treating the coated substrate.

2. The method for producing a quantum dot silicate thin film according to claim 1, wherein the quantum dots are made of a material selected from the group consisting of cadmium selenide (CdSe), cadmium sulfide (CdS), cadmium telluride, (CdTe), zinc selenide (ZnSe), zinc sulfide (ZnS), zinc telluride (ZnTe), mercury telluride (HgTe) and mixtures thereof.

3. The method for producing a quantum dot silicate thin film according to claim 1, wherein the silane compound having a phosphine-, amine- or thiol-based functional group and at least one reactive group for a sol-gel process is represented by the following formula 1:

[Formula 1]

$$L\text{-}(B)_n\text{-}SiR_mX_{3-m}$$

wherein L is a thiol group, a dialkylphosphinyl group having 1~5 carbon

atoms, or a dialkylamine group having 1~5 carbon atoms; B is methylene or siloxy (-Si-O-) group; n is an integer of 1 to 50; X is a halogen atom or an alkoxy group having 1~10 carbon atoms; R is an alkyl group having 1~10 carbon atoms; and m is an integer of 0 to 2.

4. The method for producing a quantum dot silicate thin film according to claim 3, wherein the silane compound is at least one compound selected from the group consisting of mercaptomethylmethyldimethoxysilane, 3-mercaptopropylmethyldimethoxysilane, 3-mercaptopropyltriethoxysilane, 3-mercaptopropyltrimethoxysilane, 2-diphenylphosphinoethyltriethoxysilane, diphenylphosphinoethyldimethylethoxysilane, 3-aminopropylmethyldiethoxysilane, 3-aminopropyldimethylethoxysilane, 3-aminopropyltriethoxysilane, 3-aminopropyltrimethoxysilane, 3-aminobutyltrimethoxysilane, 3-(m-aminophenoxy)propyltrimethoxysilane and n-(2-aminoethyl)-3-aminopropylmethyldimethoxysilane.

5. The method for producing a quantum dot silicate thin film according to claim 1, wherein the substrate on which the quantum dot thin film is produced is glass, quartz, a silicon (Si) wafer, a silica-coated substrate or an alumina-coated substrate.

6. The method for producing a quantum dot silicate thin film according to claim 1, wherein the coating of the quantum dots onto the substrate is carried out by drop casting, spin coating, dip coating, spray coating, flow coating or screen printing.

7. The method for producing a quantum dot silicate thin film according to claim 1, wherein the sol-gel process involves hydrolysis and condensation in the presence of a catalyst, the molar ratio of the catalyst to the monomer is within the range of 1:0.000001~1:10, the equivalent amount of water is in the range of 1.0~100.0 relative to the reactive groups present in the monomer, the reaction temperature is in the range of 0~200°C, and the reaction time is in the range of 1~100 hours.

8. A method for producing a quantum dot silicate thin film which comprises the steps of:

subjecting a silane compound and a siloxane-based monomer to a sol-gel process to form a silicate precursor, the silane compound having a phosphine-, amine- or thiol-based functional group and at least one reactive group for a sol-gel process;

mixing the silicate precursor and semiconductor quantum dots having a size of 1~100nm synthesized by a wet chemistry technique;

coating the mixture onto a substrate; and

heat-treating the coated substrate.

9. The method for producing a quantum dot silicate thin film according to claim 8, wherein the quantum dots are made of a material selected from the group consisting of cadmium selenide (CdSe), cadmium sulfide (CdS), cadmium telluride, (CdTe), zinc selenide (ZnSe), zinc sulfide (ZnS), zinc telluride (ZnTe), mercury telluride (HgTe) and mixtures thereof.

10. The method for producing a quantum dot silicate thin film according to claim 8, wherein the silane compound having a phosphine-, amine- or thiol-based functional group and at least one reactive group for the sol-gel process is represented by the following formula 1:

[Formula 1]

$$L\text{-}(B)_n\text{-}SiR_mX_{3-m}$$

wherein L is a thiol group, a dialkylphosphinyl group having 1~5 carbon atoms, or a dialkylamine group having 1~5 carbon atoms; B is methylene or siloxy (-Si-O-) group; n is an integer of 1 to 50; X is a halogen atom or an alkoxy group having 1~10 carbon atoms; R is an alkyl group having 1~10 carbon atoms; and m is an integer of 0 to 2.

11. The method for producing a quantum dot silicate thin film according to claim 10, wherein the silane compound is at least one compound selected from the group consisting of mercaptomethylmethyldimethoxysilane, 3-mercaptopropylmethyldimethoxysilane, 3-mercaptopropyltriethoxysilane, 3-mercaptopropyltrimethoxysilane, 2-diphenylphosphinoethyltriethoxysilane, diphenylphosphinoethyldimethylethoxysilane, 3-aminopropylmethyldiethoxysilane, 3-aminopropyldimethylethoxysilane, 3-aminopropyltriethoxysilane, 3-aminopropyltrimethoxysilane, 3-aminobutyltrimethoxysilane, 3-(m-aminophenoxy)propyltrimethoxysilane and n-(2-aminoethyl)-3-aminopropylmethyldimethoxysilane.

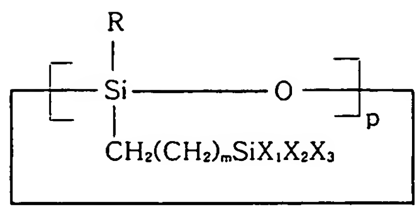
12. The method for producing a quantum dot silicate thin film according to claim 8, wherein the substrate on which the quantum dot thin film is produced is glass, quartz, a silicon (Si) wafer, a silica-coated substrate or an alumina-coated substrate.

13. The method for producing a quantum dot silicate thin film according to claim 8, wherein the coating of the quantum dots onto the substrate is carried out by drop casting, spin coating, dip coating, spray coating, flow coating or screen printing.

14. The method for producing a quantum dot silicate thin film according to claim 8, wherein the sol-gel process involves hydrolysis and condensation in the presence of a catalyst, the molar ratio of the catalyst to the monomer is within the range of 1:0.000001~1:10, the equivalent amount of water is in the range of 1.0~100.0 relative to the reactive groups present in the monomer, the reaction temperature is in the range of 0~200°C, and the reaction time is in the range of 1~100 hours.

15. The method for producing a quantum dot silicate thin film according to claim 8, wherein the siloxane-based monomer is a ring-structured siloxane monomer represented by the following formula 2:

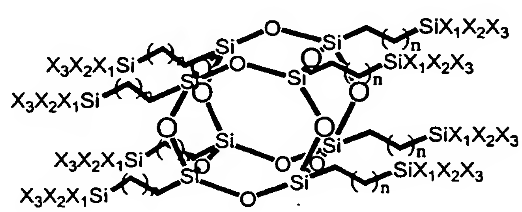
[Formula 2]



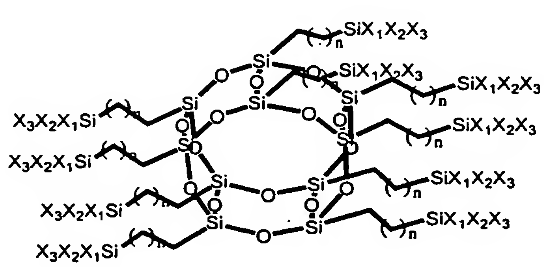
wherein R is a hydrogen atom, an alkyl group having 1~3 carbon atoms, a cycloalkyl group having 3~10 carbon atoms or an aryl group having 6~15 carbon atoms; X_1, X_2 and X_3 are each independently an alkyl group having 1~3 carbon atoms, an alkoxy group having 1~10 carbon atoms or a halogen atom, provided that at least one of X_1, X_2 and X_3 is hydrolysable; p is an integer of 3 to 8; and m is an integer of 0 to 10, or

a cage-structured siloxane monomer represented by the following formulae 3 to 5:

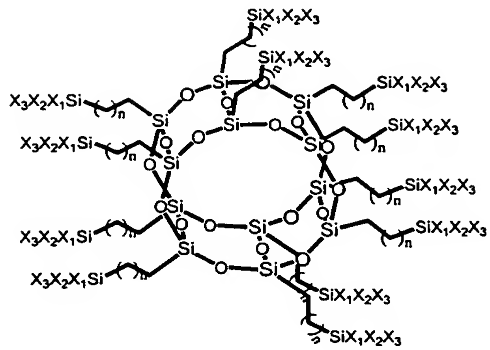
[Formula 3]



[Formula 4]



[Formula 5]



wherein X_1, X_2 and X_3 are each independently an alkyl group having 1~3 carbon atoms, an alkoxy group having 1~10 carbon atoms or an halogen atom, provided that at least one of X_1, X_2 and X_3 is hydrolysable; and n is an integer of 0 to 10, and

if necessary, a silane compound is added to the siloxane-based monomer, represented by the following formulae 6 to 8:

[Formula 6]

$$SiX_1X_2X_3X_4$$

[Formula 7]

$$R_1SiX_1X_2X_3$$

[Formula 8]

$$R_1R_2SiX_1X_2$$

wherein R_1 and R_2 are each independently a hydrogen atom, an alkyl group having 1~3 carbon atoms, a cycloalkyl group having 3~10 carbon atoms or an aryl group having 6~15 carbon atoms; and X_1, X_2, X_3 and X_4 are each independently an alkoxy group having 1~10 carbon atoms or a halogen atom.

16. The method for producing a quantum dot silicate thin film according to claim 8, wherein the silane compound and the siloxane-based monomer is reacted in the molar ratio of 99:1 ~ 1:99.

17. The method for producing a quantum dot silicate thin film according to claim 8, wherein the silicate precursor and the quantum dots are mixed in the weight ratio of 99:1~50:50.

18. A quantum dot silicate thin film produced by the method of claim 1.

19. A quantum dot silicate thin film produced by the method of claim 8.